EXPERIMENTAL EVALUATION OF ATMOSPHERIC EFFECTS ON RADIOMETRIC MEASUREMENTS USING THE EREP OF SKYLAB (EPN No. 439)

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1. Program Summary

Segments of EREP S192 digital data for selected test sites were dumped from received computer compatible tapes, calibrated, area averaged, and plotted. Model calculations were compared to these data. Atmospheric effects were calculated for model atmosphere-surface combinations simulating EREP S192 data.

2. Work Accomplished During the Reporting Period

The following S192 CCTS were received during the quarter for EREP pass 39 (Salt Lake Desert area): 934828/934829/934830/934831. This shipment completed the S192 data requirement.

A technique was developed to handle retrieval of EREP S192 calibrated radiances from the CCTS in an efficient manner. This was necessitated by the inherent inaccuracy of locating specific data pixels using latitude-longitude location alone and the high density of data recorded on a given CCT GMT segment. Target surface sites were selected and calibrated radiances calculated using the available digital-analog conversion constants. For each test site, model calculations were made to simulate S192 data using nearby radiosonde atmospheric properties and ground truth surface reflectance (when possible) as input data. Validation of model calculations is a prerequisite to using the model to evaluate atmospheric effects. Comparisons indicate the following:

(a) Overall, fit of the synthetic spectra to the data is quite good in bands 4, 5, 6, 7, 8. Error bars ($\pm$ 10%) on model radiances conform well within the variability of the data sample from the mean areal average.

(b) In bands 1, 2, 3, model calculations consistently overestimate measured radiances. It is believed that this is due to the assumption of linear response in determining equivalent lamp radiances at moderately high digital outputs. However, the overestimation also holds true in test cases over low reflectance (water) surface targets.

(c) Model calculations have a tendency to overestimate band radiances in the near infrared region (bands 9, 10, 11, 12). It is concluded that path radiance in this region has been overestimated, especially at high surface reflectance values.

Calculations have been performed to yield the change in apparent surface reflectance due to atmospheric effects above the true surface reflectance. Additionally, contrast modification and possible band ratio alterations due to the atmosphere have been investigated. These results are subject to the inherent inaccuracies of the model calculations indicated above.

3. Significant Results

There are no significant results to report at this time. A brief presentation entitled "Evaluation of Atmospheric Effects on Radiometric Measurements Using the EREP of SKYLAB" will be presented to the 56th Annual Meeting of the AGU in June. Results up to that time will be summarized. The abstract is attached.

4. Data Outstanding

ERAP A/C data for EREP pass 2 has not yet been received. We have been informed that it is not available in the form requested (i.e. simulated S192 radiances) but only as monochromatic, uncalibrated, raw data stream. It may be an expensive undertaking to put the data in a useful format. We have agreed, however, to receive the data and determine whether or not it is possible to use it within time and dollar constraints. A time extension has been requested for this purpose.

5. Future Plans

Data analysis will continue. Further investigation of the theoretical calculations will be undertaken to compute simulated EREP radiances using a multifrequency, full scattering radiative transfer program in the S192 wavelength region to improve accuracy in the treatment of path radiance components.

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EVALUATION OF ATMOSPHERIC EFFECTS ON RADIOMETRIC MEASUREMENTS USING THE EREP OF SKYLAB

Techniques for monitoring earth resources using multispectral sensors at visible and near infrared wavelengths rely on the observer's abili[illegible] establish a one-to-one correspondence between the spectral properties of the surface and those of the reflected solar intensity measured at the spacecraft. Unfortunately, the atmosphere between the spacecraft sensor and the surface target is an integral, though generally uncontrollable part of the total measurement system. Atmospheric gases absorb, emit, and scatter solar radiation in a unique and spectrally structured manner. Consequently, the sensor responds not only to the radiant energy reflected by the target surface, but also to the radiative processes of the atmosphere within its field of view. In the context of resource monitoring, these contributions to the measured intensity constitute a source of system introduced noise.

Results emphasize the atmospheric effect in modifying surface spectral properties as monitored from the Skylab EREP sensors. Implications in resource monitoring are discussed.

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